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Goat Farmers' Coping Strategy for Sustainable Livelihood Security in Arid Rajasthan: An Empirical Analysis[1]

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Abstract

Goat farmers' coping strategy under water scarcity and changing resource situations in the arid Rajasthan has been analyzed. Input-output model has been used to quantify the magnitude of linkages amongst different components of the farming system. The study is based on the primary data collected from randomly selected 60 goats-keeping households and 25 farm households without goats for the year 2004-2005 from the Nagaur district in arid Rajasthan. Instead of opting for transhumance system, the farmers have been found innovative in evolving a farming system that has allowed sustainable production of grains for family as well as feed and fodder for maintaining their small ruminants. Three farming systems, (I) Rain-fed goat-based farming system, (II) Partially irrigated goat-based farming system, and (III) Rain-fed crop-based farming system, have been delineated. In response to the emerging resource and environmental conditions, goat farmers have utilized the potential synergy of linkages among different components of the farming system. However, the existing goat production needs to be fine-tuned with the modern goat-rearing practices. The innovative idea of farmers of keeping a part of their land fallow for grazing their goats and sheep during the lean season needs to be used as an opportunity to encourage the farmers to develop this fallow land as pasture with recommended legume and non-legume grasses. This model may be replicated in similar other arid regions.

Introduction

Agriculture and livestock production in arid Rajasthan is severely affected by frequent droughts. Inadequate rainfall, extreme temperature, and poor quality of land and groundwater further restrict the choice for crop and livestock to farmers in the region. High population growth and poor infrastructure escalate the problems of resource-poor rural people. Faced with low productivity and high uncertainty in crop production, rural people are heavily dependent for their livelihood on common property resources (CPRs)-based livestock rearing, particularly small ruminants (Pasha, 1991). The CPRs-based small ruminant rearing is a preferred option as self-employment for the resource-poor rural people. Among the small ruminants, goats are far more widely distributed (Rath, 1992) and contribute a significant source of supplementary income and family nutrition to these poor rural people (Kumar and Deoghare, 2003). Nevertheless, the quality and quantity of common property resources as a source of feed and fodder have severely depleted during the past couple of decades. As a result of continuous depletion of common grazing resources, the traditional goat farmers in the arid Rajasthan are either forced to reduce the size of their goat flocks or adopt transhumance system of goat production. Thus, the livelihood security of these rural households of the rain-fed arid Rajasthan is under threat. There is a need to evolve sustainable farming systems for such water-scarce situations, exploiting the potential synergy among different components of the farming system. Farming systems

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approach has been suggested to meet the multiple objectives of poverty reduction, food security, competitiveness and sustainability under resource-scarce situations (Goldsworthy and deVries, 1994). The systems approach emphasizes the need to view the farm situation as a whole and not in a compartmentalized manner. To achieve a sustainable farming system, an individual farmer allocates certain quantities and qualities of four factors of production, viz. land, labour, capital, and management to which he has access. The strong linkages amongst the components of the farming system enhance its productivity (Arya and Kalla, 1992; Kumar and Jain, 2002). A number of farmers in highly water-scarce rain-fed areas of Rajasthan, where transhumance system is common, have alternatively evolved a goat-based integrated farming system as a means of sustainable livelihood. The farmers have adopted sustainable ways of integrated farming with goats as major component of the system. A case study of such a system using potential synergy of all its components may be useful for replication of this model under similar situations and for finding leverage points for its further improvement. Therefore, this paper analyzed a case of goat-based integrated farming system adopted by farmers as a coping strategy under limited water and changing resource situations in the arid region of Rajasthan. The study has also quantified the magnitude of linkages amongst different components of farming system and has suggested ways for improvements in the farming system.

Data and Methodology

The study was conducted in the Nagaur district of arid Rajasthan, with most of its area as rain-fed. It represents the home tract of 'Sirohi' breed of goat, which is one of the most important and widely adopted goat breeds of India. The temperature in the study area reaches as low as 0 °C during winters and as high as 48 °C during summers. The average annual rainfall is around 360 mm. There were two types of farm households in this region; one who owned and operated only rain-fed lands and were in majority (75 per cent); and second, who had limited access to assured irrigation for a part of their land only during *rabi* season. Tube-well was the major source of irrigation water. The cropping intensity was around 150 per cent on farms having access to irrigation and 100 per cent for the rest. The *Sapher* block of Nagaur district was purposively selected to study the goat-based sustainable farming system evolved by the farmers. A complete enumeration of all the households in the selected villages, namely *Kachaulia* and *Devari* of the selected block was carried out. Using random sampling, a sample of 60 goat-keeping households and 25 farm-households without goats was selected. The sample size of 85 households formed 50 per cent of the total number of households in the selected villages. The selected households were post-stratified into three farming system groups, namely I: Goat-based rain-fed farms, II: Goat-based partially irrigated farms having limited access to irrigation during *rabi* season, and III: Crop-based rain-fed farms. Detailed information was collected on socio-economic conditions of these households, systems of goat rearing and their resilience in the changing agro-economic situation and marketing of live goats, level of interactions and resource flows among different components of the system, occupational structure and strategies adopted by the farmers for enhancing sustainability of the farming system. The primary data were collected for the year 2004-2005 through personal interview method with the help of pre-structured survey schedule. The data mainly pertained to the size of goat enterprise, family size, age, education, assets of farmers; initial capital, fixed cost, labour, purchased as well as family-grown inputs used, mode of integration of goats with other farm activities, practices followed for goat rearing, level and type of feeds used for grazing of goats; output from goats and its utilization and disposal, efforts made by farmers to acquire new technology, magnitude of linkages in terms of output of one sub-sector being used as input of other sub-sector of the farming system and the major constraints in goat production and marketing.

Model

To quantify linkages amongst various components of farming system, the static input-output model was used (Leontief, 1966; Sharma *et al.*, 1991; Kumar and Jain, 2002). The static input-output analysis shows the purchase of each sector/activity from rest of the components of individual farmer's economy and accounts for the sales of each sector of a farm to all others. The total sales of any one sector to all other sectors including sales to households and market form the final output of that particular sector. The household sector was termed as autonomous sector ($Ø_i$) in the study.

The input-output model may be described by Equation (1):

$$£_i = \Sigma\, £_{ij} + Ø_i \quad (i = 1, 2, 3, ..., m; j = 1, 2, 3, ..., n) \quad \ldots(1)$$

where, '$£_i$' is the output of any intermediate sector and $£_{ij}$ represents component flows from the i^{th} sector to the j^{th} sector and $Ø_i$ is the final output for household consumption and market.

Equation (1) may also be written as Equation (2):

$$£_i - \Sigma\, £_{ij} = Ø_i \quad (i = 1, 2, 3, ..., m; j = 1, 2, 3, ..., n) \quad \ldots(2)$$

The relationship thus obtained can be expressed in terms of production coefficients (a_{ij}) and may be described as Equation (3):

$$a_{ij} = \frac{£_{ij}}{£_j} \quad (i = 1, 2, 3, ..., m; j = 1, 2, 3, ..., n) \quad \ldots(3)$$

This may also be expressed as Equation (4):

$$£_{ij} = a_{ij}\, £_j \quad \ldots(4)$$

where, $£_j$ is the total output of the sector 'j'.

In the above formulation, 'a_{ij}' gives the worth of produce of the 'ith' sector required by the sector 'j' per unit value of output of sector 'j'.

Substitution of values of '$£_{ij}$' of Equation (4) in Equation (2) yields Equation (5):

$$£_i - \Sigma\, a_{ij}\, £_j = Ø_i \quad \ldots(5)$$

Equation (5) represents the functional relationship between the autonomous sectors and net output ($£_i$) and the relationship between intermediate sectors (a_{ij}) in the farm. The inputs and outputs of various activities/ enterprises were taken in value terms.

The animals, especially small ruminants were out for grazing in CPRs and fallow-lands for 8–10 hours daily for 7 months in a year. The small ruminants met their 80 per cent feed requirements from grazing during these 7 months and 40 per cent during rest of the period in a year. The large ruminants met their 40 per cent feed requirements from CPRs and fallow lands for 3–4 months. Hence the contribution of CPRs and fallow lands in livestock output was estimated as the average daily maintenance feed requirements of goats multiplied by the number of days of grazing. This amount was discounted depending on the proportion of feed requirement of animals met from the CPRs. Thus, an approximate value of contribution of CPRs and fallow lands to livestock was calculated.

Results and Discussion

Socio-economic Background and Cropping System

The Nagaur district of Rajasthan is drought-prone and frequently suffers from severe droughts. Even during a normal rainfall year, farmers can grow only *kharif* crops due to less and erratic rainfall and poor water-holding capacity of the soil. Very low level and poor quality of groundwater further restrict the crop choice. Under such circumstances, farmers preferred goat-based mixed farming system which could fulfill their requirement of food, feed and fodder, fuel on one hand and provide regular income and employment on the other. Rearing of large animals was also not economical as well as feasible due high scarcity of feed and fodder. Goat and sheep rearing has become the major source of rural livelihoods.

A large number of goat and sheep keepers of the arid Rajasthan migrate to other areas/ states every year in search of feed for their animals. However, the farmers covered under this case study were innovative to evolve a farming system that allowed sustainable production of grains for family as well as feed and fodder for maintaining their small ruminants. Three farming systems, namely (I): Rain-fed goat-based farming system, (II): Partially irrigated goat-based farming system, and (III): Rain-fed crop-based farming system were delineated based on the type of activity mix and access and type of source of water for agriculture. Only 26 per cent of the total cultivated area of the selected villages had access to assured irrigation during the *rabi* seasons.

The productivity of common grazing lands in Rajasthan has become low throughout the year due to heavy grazing pressure and lack of efforts for their regeneration (Jodha, 1990). The access to grazing resources was further reduced during the rainy season as it was the main cropping season with almost no current fallow land available for grazing. However, the farmers under rain-fed goat-based farming system strategically planned their crop rotations and kept a part of their land fallow even in the main cropping season of *kharif* (Table 1). Since farmers firmly

Table 1. Area under different crop rotations in goat-based farming systems

Sl No.	Crop rotation (for 2 years)				Share of total cultivated area, %	Cropping intensity
	Kharif	*Rabi*	*Kharif*	*Rabi*		
	With limited access to irrigation					
1	Bajra	Mustard	Fallow	Wheat	28	150
2	Fodder	Mustard	Fallow	Wheat	22	150
3	Fallow	Wheat/Barley	Bajra/Moth	Mustard	34	150
4	Fallow	Lucerne/Onion	Fodder	Wheat	16	150
	Rain-fed farming					
1	Bajra/sesame	Fallow	Moth-bean/Mung	Fallow	40	100
2	Moth bean	Fallow	Bajra/Gwar	Fallow	40	100
3	Fallow	Fallow	Bajra	Fallow	20	50

Table 2. Use of own current fallow land

Sl No.	Type of land	Season	Area kept fallow for grazing, %	Type of grazing
1	Irrigated land	*Kharif*	50	Controlled access
		Rabi	0	- -
2	Rain-fed land	*Kharif*	20	Controlled access
		Rabi	100	Open access

Table 3. Some characteristics of farm households under different farming systems

Particulars	Goat-based integrated farming system		Crop-based farming system III
	I (Rain-fed)	II (Partly irrigated)	
No. of farmers	39	21	25
Average age of farmer, years	43.36	40.48	48.20
Farmers literate, %	12.82	19.05	16.00
Average number of total goats	17.85	19.19	0.00
Average number of breeding does	10.72	11.86	0.00
Average number of breeding ewes	5.23	7.76	0.00
Average number of milch buffalo	1.87	1.19	2.48
Average number of milch cows	1.26	1.05	3.62
Average farm size, ha	2.69	3.01	3.26
Availability of family labour (average human-days)	4.74	4.95	4.08

Note: A breeding female-goat is called 'Doe' and breeding female-sheep is called 'Ewe'

believed that goat and sheep could be reared successfully only under the extensive system with grazing as the major component of feeding. Hence, contrary to the normal practice in Rajasthan, they kept 20–50 per cent of their farm land fallow in the *kharif* season and 0–100 per cent in the r*abi* season to be used as pasture for grazing their animals in goat-based farming systems (Table 2).

A majority of farmers were illiterate and had landholding in the range of 2.69–3.26 ha (Table 3). The farming systems I and II were quite diversified with goat rearing as the major economic activity. Non-adoption of small ruminants in the farming system III might be due to the limitation of family labour and older age of the farmers. Although the goat rearing has traditionally been associated with the socially and

Table 4. Distribution of goat keepers among social groups

(% farmers)

Particulars	Goat-based integrated farming system		Crop-based farming system III
	I (Rain-fed)	II (Partly irrigated)	
Scheduled castes	35.90	23.81	8.00
Other backward castes	41.03	52.38	48.00
General castes	23.07	23.81	44.00

economically backward sections of rural society, the goat-based farming system was evenly adopted by farmers belonging to all the social groups, indicating its high social acceptability (Table 4).

Resource Flows and Farmers' Coping Strategy

In response to the emerging resource and environmental conditions, goat farmers utilized the potential synergy of linkages among different components of the farming system. On the rain-fed farms, the maximum area in *kharif* season was occupied by crops, but farmers kept about 20 per cent of their land fallow for grazing the animals. Farmers sold most of their unproductive animals and surplus kids in the months of May and June for restricting their flocks due to lack of grazing resources. They maintained only adult males and pregnant goats/sheep during the rainy season and reared them under semi-intensive system. The animals for remaining period of the year, October to June, were grazed on owned fallow land and open access grazing land (Figure 1). After harvesting the *kharif* crops, total rain-fed area was left fallow during *rabi* and summer season and was used as open access for grazing. The kidding of goats and sheep during September-October led to increase in flock size again. This strategy helped farmers in generating additional income and employment from goats, and maintaining soil fertility of the land for sustainable crop production. In this way, farmers raised the crops for food and earned cash income from the sale of surplus live goats and sheep, and milk, besides manure for nutritional balance of soil. On the other hand, the farmers having access to assured irrigation for the *rabi* crop, kept half of their land as fallow in the *kharif* season for grazing their goats, but sown crops in the whole farm during the *rabi* season. During winter, goats of these farmers were fed on common feed resources and open access private fallow lands of rain-fed farmers and purchased fodder and tree leaves. The farmers having access to irrigation during the *rabi* season had added advantage of grazing their goats on current fallow land of other farmers (rain-fed) without any reciprocity. It was an innovative idea of farmers to keep a part of their land fallow during the *kharif* season for grazing of their small ruminants. But, the productivity of the farming system would be much higher if the current fallow land was developed as a pasture with the recommended legume and non-legume grasses and used for grazing.

Quantifying Interdependence among Different Components of Farming System

The quantitative relationships among various components of the three farming systems have been presented in Table 5. In the rain-fed goat-based farming system, the annual output of small ruminants worth Rs 29,192 utilized feed and fodder inputs worth Rs 2,061 from crops and Rs 7,274 from CPRs and fallow lands. The cow and buffalo used inputs worth Rs 9,046 and Rs 4,964 from crops and CPRs, respectively. The crop sub-sector on an average required livestock inputs in the form of farm yard manure and draught power worth Rs 2,296. The livestock also supplied dung worth Rs 838 as input to CPRs and fallow lands. This indicates the symbiotic relationship among crops, livestock and CPRs. The cost of contribution of family labour in livestock output was Rs 15,335, which indicated the labour-intensive nature of the livestock/ goat enterprise. The household sector consumed small ruminants' output worth Rs 3,525 and that of large ruminants worth Rs 1,180, which accounted for 12 per cent and 5 per cent of their respective total outputs, indicating the greater role of goats in nutritional security of the family. The market shares in total output of goat and sheep, buffalo and cow, and crops were 82 per cent, 93 per cent, and 31 per cent, respectively.

The input-output coefficients developed for the rain-fed goat-based farming system revealed that goat

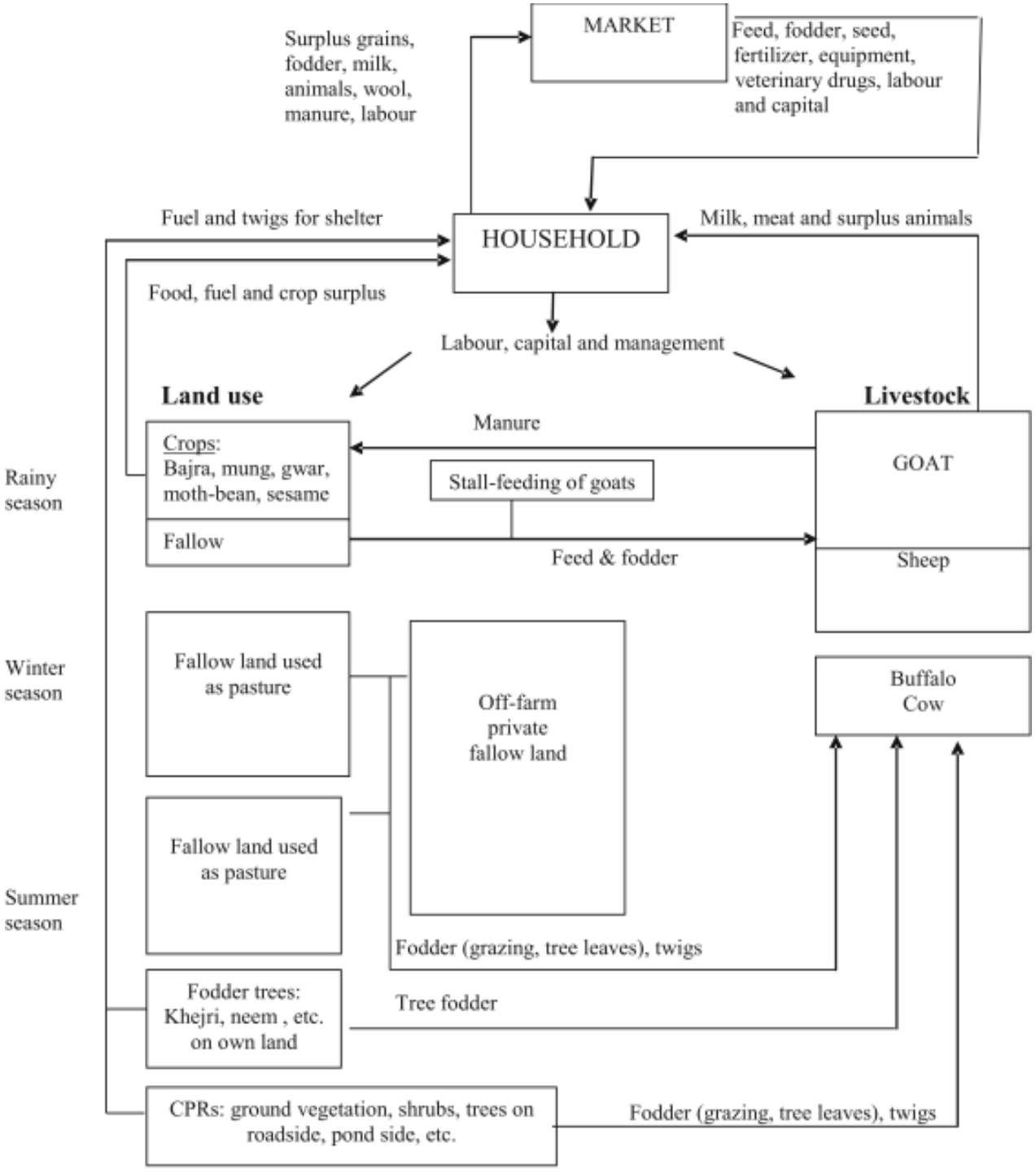

Figure 1. Resource flows and interactions in rain-fed goat-based integrated farming system: A diagrammatic presentation

and sheep output of rupee one required crop input worth 7 paise, family labour, 34 paise and market-oriented inputs, 7 paise. The contribution of CPRs and fallow lands in the livestock output was prominent and accounted for 25 paise for goat and sheep and 21 paise for buffalo and cow. In the case of buffalo and cow, the contribution of crops and market-oriented inputs was 39 paise and 11 paise, respectively for output of each rupee. Each rupee of output of crops consumed livestock input worth 8 paise, labour worth 7 paise

Table 5. Transaction matrix for different farming systems

(Rs/ household/ annum)

Producing sectors	Consuming sectors					Market	Gross returns
	Goat and sheep	Buffalo and cow	Crops	CPRs and fallow land	Household		
Rain-fed goat-based farming system							
Goat and sheep	-	-	1820 (0.066)	530+ (0.041)	3525	23847	29192
Buffalo and cow	-	-	476 (0.017)	308+ (0.024)	1180	21554	23210
Crops	2061 (0.071)	9046 (0.390)	312 (0.011)	-	7580	8611	27610
CPRs and fallow land	7274 * (0.249)	4964 * (0.214)	-	-	706	-	12944
Labour	10030 (0.344)	5305 (0.229)	1883 (0.068)	-	17218@	936$	18154
Market-oriented inputs	1942 (0.067)	2466 (0.106)	12322 (0.446)	-	-	-	-
Total cost	14033	16817	16813	-	-	-	-
Goat-based farming system with limited assured irrigation in r*abi* season							
Goat and sheep	-	-	1708 (0.049)	792+ (0.040)	3678	29307	34693
Buffalo and cow	-	-	712 (0.020)	297+ (0.015)	677	12511	13900
Crops	2195 (0.063)	6149 (0.442)	196 (0.006)	-	7230	19429	35199
CPRs and fallow land	13320* (0.384)	6007* (0.432)	-	-	488	-	19815
Labour	12030 (0.347)	4116 (0.296)	2400 (0.068)	-	18546@	1800$	20346
Market-oriented inputs	1421 (0.041)	2517 (0.181)	16885 (0.480)	-	-	-	-
Total cost	15646	12782	21875	-	-	-	-
Rain-fed crop-based farming system							
Buffalo and cow	-	-	891 (0.024)	326+ (0.067)	3212	36047	40150
Crops	-	18862 (0.470)	402 (0.011)	-	8745	9403	37412
CPRs and fallow land	-	4050* (0.101)	-	-	815	-	4865
Labour	-	7984 (0.199)	2250 (0.060)	-	10234@	1206$	11440
Market-oriented inputs	-	8762 (0.218)	18144 (0.485)	-	-	-	-
Total cost	-	35608	21689	-	-	-	-

Notes: Figures within the parentheses are inputoutput coefficients.
@Indicates total contribution of the family labour.
$Indicates total contribution of hired labour.
*The amount not accounted in the total cost
+The amount not accounted in the gross returns

and market-oriented inputs worth 45 paise. The market-oriented inputs for crops mainly constituted seeds, fertilizers and hiring charges of tractor for ploughing, sowing and threshing. Such input-output coefficients were developed for all the three farming systems.

The study of linkages helped to demonstrate the role played by various farming sub-systems in the livelihoods of rural people. A change in one component of the farming system would significantly affect the other components as well as functioning of the entire system. It was revealed that crop and livestock (especially small ruminants) enterprises were integrated components of the farming systems in the study area. Crops provided crop-residues for goats and other livestock and the livestock produced manure for the field. Besides, livestock also provided draught power for farming and, milk for the family. The small ruminants with 8-10 hours of daily grazing also provided nutrients to the current fallow and common lands through their droppings and dung during grazing. Grazing on common and own fallow lands and lopping from trees on owned and common lands was a major source of fodder for small ruminants and other livestock. The traditional strength in terms of using the farm produced resources with low opportunity cost, has given way to specialized livestock production activities with milk and meat production as predominant objectives. It was obvious from the fact that goats and other livestock made a major contribution to the total farm production under goat-based farming systems, where live goats and sheep had their major share in the total livestock output. It was evident from the magnitude of linkage coefficients given in the transaction matrix table that the forward linkages (crop, CPRs and fallow lands to livestock) as well as backward linkages (livestock to crops and CPRs) were quite robust under the goat-based farming systems (Table 5). The strong linkages among different components of the farming system enhanced the sustainability and economic viability of the system. The forward linkages were, however, stronger as compared to backward linkages. The livestock to crop linkages were observed to be generally weak which could be due to low cropping intensity and massive substitution of manure by chemical fertilizers and bullocks by tractors Arya and Kalla (1992) and Kumar and Jain (2002) have also reported similar findings.

Sources of Income Generation

Goat rearing was the most dominant activity in the goat-based farming systems in terms of both contribution to household's total income and employment generation. The farmers best utilized the family labour through goat and sheep rearing activities for ensuring livelihood security to their families under high water-scarce conditions. The goat and sheep activity generated a total of 200.6 and 240.6 human-days per annum in the farming systems I and II, respectively (Table 6).

Economics of goat farming demonstrated that the imputed value of family labour was the major component of total expenditure on goat rearing, which accounted for 55-62 per cent of the total cost of goat rearing. The opportunity cost of family labour was very low or negligible. The actual expenditure on rearing a goat was only Rs 531 and Rs 440 per annum in the rain-fed and partially-irrigated farming systems, respectively. The higher expenditure under the rain-fed farming system on rearing a goat was mainly due to comparatively higher expenses on the purchasing of feed and fodder (Table 7). The farmers reared goats as a source of milk. However, the value of live kids sold and added stock constituted the largest share of gross returns. The farmers earned the net annual income of Rs 1,539 to Rs 1,654 per goat. The higher income per goat on partially-irrigated farms was mainly due

Table 6. Annual labour-use in goat rearing

(human-days)

Particulars	Goat-based integrated farming system	
	I (Rain-fed)	II (Partly irrigated)
Labour-use in goat rearing	141.00	168.20
Labour-use in sheep rearing	59.60	72.40
Labour-use in grazing (per cent of total labour-use)	82.40	85.32
Labour-use per goat	13.15	14.21

Table 7. Costs and returns from goat rearing in Rajasthan

(Rs/ annum)

Particulars	Goat-based integrated farming system	
	I (Rain-fed)	II (Partly irrigated)
Costs:		
Fixed cost: (Depreciation + interest)	2084	1978
Variable cost :		
Feed & fodder (straw, *pala*, tree leaves, concentrate, oil)	3375	3006
Imputed value of family labour	7050	8410
Other expenditure (grazer's charges, medicines, repairs, hiring of breeding male)	235	226
Total variable cost	10660	11642
Total cost	12744	13620
Total cost, excluding family labour cost	5694	5210
Paid-up cost per doe	531	440
Returns:		
Value of milk	8062	8819
Value of kids sold and added stock	12672	14742
Value of manure and income from buck	1453	1242
Gross returns	22187	24803
Net returns	9443	11183
Family labour income	16493	19593
Family labour income / goat	1539	1654
Income from goat/ human-day	117	116

Table 8. Different sources of family income and relative share of goat farming

(Rs/ annum)

Particulars	Goat-based integrated farming system		Rain-fed crop based farming system III
	I (Rain-fed)	II (Partly irrigated)	
Goat rearing	16493	19593	-
Sheep rearing	4345	4637	-
Dairy cow	1782	1590	5170
Dairy buffalo	4952	3644	7356
Crop cultivation	12680	15724	17980
Total income of the farming system	**40252**	**45188**	**30506**
Agricultural wages	6071	7910	4580
Non-farm wages	436	287	3152
Family's total income	46759	53385	38238
Goats' share in households' total income, %	35.27	36.70	0.0
Goats' share in total farm income, %	40.97	43.36	0.0
Farm income per ha	14964	15013	9357

to lower cost of production on account of feed. However, the net returns per human-day from goat rearing were not significantly different under both the farming systems. It was mainly due to higher labour-use for rearing a goat under partially-irrigated farming system.

Goat rearing contributed the major share to the total farm income in both the goat-based farming systems and provided livelihood security to the farm family in the poorly endowed arid region (Table 8). Its share in the household's total income was 35 – 37 per cent and contribution to the total farm income was 41

– 43 per cent. The net-returns per hectare were 60 per cent higher on rain-fed goat-based farming system than the crop-based farming system. It indicates the better economic viability and sustainability of goat-based farming system in the arid Rajasthan.

Despite significant efforts of the farmers, it has not been possible to realize the full potential mainly due to lack of market for milk and live animals. The distress sale of live goats to the local butcher was a common phenomenon. The incidence of diseases in goats and sheep, in the absence of proper prevention, was a cause of concern and constrained the productivity of animals. Farmers' awareness about the market was also low and they did not have easy access to institutional finance.

Conclusions and Policy Implications

The study has demonstrated the coping strategy of farmers in the arid Rajasthan. It can be concluded that the goat-based farming systems evolved by the farmers in the arid Rajasthan is not only economically viable but sustainable also. Diversification and strong linkages among different components of the farming system have a synergistic effect on the functioning of entire farming system and result in higher income. However, the farmers would be able to generate more income, if the existing goat production is fine tuned with modern goat-rearing practices. The innovative idea of farmers of keeping a part of their land fallow for grazing their goats and sheep during the lean season needs to be used as an opportunity to encourage the farmers to develop this fallow land as pasture with recommended legume and non-legume grasses. Moreover, provision of market information, enhancing competition in milk and live animal market through organized efforts, access to improved technologies, critical inputs like vaccines, improved fodder seeds, and easy institutional finance have been identified as crucial for strengthening the goat-based farming systems in the area. This model should be replicated in similar other arid regions.

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